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Saskatchewan Exploration and Development Highlights 1993

Andrew J. Gracie and Pamela L. Schwann

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Projected 1993 exploration expenditures of $22 million in northern Saskatchewan equal actual expenditures incurred in 1992 (Table 1). Underground development costs at the Cigar Lake, Eagle Point, and McArthur River uranium deposits are forecast to be seven times those for grassroots uranium exploration, which have remained stable for three years. Base metal expenditures are also expected to remain unchanged, whereas those for gold are predicted to decline. Underground development costs at Contact Lake and Komis are estimated to be three times those for grassroots exploration in gold. Diamond exploration expenditures will rise significantly.

Table 1- Exploration expenditures.

	1992 (actual)	1993 (estimated)
Uranium	8 (57)	10 (72)
Gold	6	3 (9)
Base Metals (Including PGES)	4	3
Diamonds	4	6
Total	22	22

Note:
Figures are rounded to the nearest million dollars.
Uranium and gold test mine expenditures are in brackets. Part of the gold test mine expenditures will be incurred in 1994.

URANIUM

Saskatchewan remains the focus of uranium exploration in Canada. Although no new world class discoveries may be reported again this year, five major projects are at various stages of development. An excellent reserve base and spot prices of about $10/lb continue to curtail exploration.

Cameco is the key player in uranium mining and exploration and commands 47 percent of currently identified reserves. Cameco's ownership is now: public shareholders (51.5%), Government of Saskatchewan (38.9%), and Government of Canada (9.6%). Saskatchewan's mines produced 8354 t U in 1992, making the province the world's leading producer with roughly 90 percent of Canadian output and 23 percent of world output. Sales amounted to 7.46 million kg U valued at $381 million in 1992. Uranium production and sales in 1993 will match or possibly exceed those of 1992.

Reserves and production figures for the three main mines are presented in Table 2. Currently identified reserves within the Athabasca Basin are sufficient to sustain production well into the next century. On the exploration side, some ten companies still remain part of uranium exploration joint ventures. Exploration in the east and southeast part of the Athabasca Basin is aimed at the discovery of another major deposit of the Key Lake–Cigar Lake unconformity type. Mineralized holes are common in this area where programs may test unconformity targets at depths exceeding 500 m. Although no major discoveries were made this year, the area still holds great potential, especially at these depths; however, funds for a major exploration effort are not available due to the low price of uranium and the excellent reserve position. The uranium industry in northern Saskatchewan is currently in a development phase.

Rabbit Lake

Cameco, operator (66.7%); Uranerz Exploration and Mining Ltd. (33.3%)

When processing of ore from the existing Collins B stockpile is complete in 1994, the mill is scheduled to use ore first from the Eagle Point underground mine, then from the high grade Collins Bay A and D zone open pits. Ore from the B zone stockpile provided mill feed at Rabbit Lake, which operated in 1992 on a 50 percent, alternate week basis, producing 2160 t U in 1992. At year's end the Rabbit Lake stockpile contained 3650 t U, including some Eagle Point ore. In 1992, 22 000 t ore grading 1.43 percent U were recovered from the first Eagle Point stope. Three stopes have now been completed in the subvertical 02 zone. A special 1993 mill test of Eagle Point ore processed 39 000 t grading 1.47 percent U. Total 1993 estimated production, including ore from Eagle and the stockpiled B zone, will be 361 500 t at 0.67 percent U. With 95.5 percent recovery, Rabbit Lake will produce 2300 t U again in 1993 (Table 2).

Cameco has reduced reserves in the Eagle Point deposit. In 1992, underground drilling on the 02 zone, totaling 344 holes and 31 500 m, revealed that the mineralization is mostly contained in a number of relatively high grade, vertical structures, which could not have been identified from the drilling program conducted from the surface of Wollaston Lake some ten years ago. The reassessment of Eagle Point indicates total reserves of approximately 24 600 t U with an estimated grade of 1.27 percent U, compared with the previously stated 47 000 t with a grade of 0.83 percent U. Cameco expects that production rates and costs of production previously anticipated for the period 1993 to 2002 remain achievable, because of the increase in grade and the conservative manner in which future development rates

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and costs at Eagle Point over estimated. The 1993 drill program concentrated on the southern part of the Eagle Point deposit with encouraging results. A 1994 test stope is planned for the 144 zone which dips at 45° to 50° to the west in the southern portion of the mine.

Cluff Lake

Cogema Resources Inc., operator (80%); Corona Grande Exploration Corp. (20%)

The Cogema Group's North American activities, including Amok Ltd., will be centrally managed as Cogema Resources Inc., with headquarters in Saskatoon. Cameco has sold its 20 percent interest in the Cluff Mining partnership to Corona Grande Exploration Corp., a wholly owned subsidiary of Cogema Canada Ltd.. During 1992 and 1993 there was no open pit mining activity at Cluff Lake. The 1992 mill production of 742 t U came from the Dominique-Peter underground mine and from the stockpile of Dominique-Janine open pit ore. In 1993, mining will continue until the first week of December, producing in excess of 1000 t U and milling to mid-December, producing about 808 t U (Table 2). Because soft market conditions continue, the company operates the mill on alternate weeks only and shuts down the Dominique-Peter mine in the winter months. The two stage Dominique-Janine open pit extension, planned for full production in 1995, has been recommended for development by the Joint Federal-Provincial Panel on Uranium Mining Developments, but has not yet received governments' approval. The new pit reserves are estimated to be 850 000 t grading 0.59 percent (5000 t U) and these reserves will take seven years to mine once approval is received. The ultimate pit contour will extend beyond the current Cluff Lake shoreline and will require a damming structure to be built in the lake as outlined in the Environmental Impact Statement (EIS). Meanwhile, Cogema Resources Inc. has continued to develop and better define Dominique-Peter mine reserves from underground haulage access ramps on two levels to the north and west of the Dominique-Peter southeast area. Surface drill programs have followed up

Table 2 - Published reserves from Saskatchewan uranium mines.

Owner(s)*	Property/Deposit	Reserves (t U) (Unstandardized)	Grade %U	Production (t U) 1992***	1993****
	MINEABLE**				
Cameco-Uranerz	Collins Bay B	3 300	0.5	2160*****	2300
	Collins A	6 500	4.82	-	-
	Collins D	2 200	1.86	-	-
	Deilmann	31 300	1.34	5452	5400
	Eagle Point	11 000	1.4	-	-
Cogema-Corona Grande	Cluff Lake	15 000	0.73	742	808
Cogema-Denison	McClean, JEB, and Sue Trend	17 300	2.7	-	-
Cogema-Denison-Uranerz-Bow Valley-OURD-Numac	'Midwest' Lake	14 000	3.8	-	-
	GEOLOGICAL**				
Cameco-Uranerz	Eagle Point	14 000	1.2	-	-
Cameco-Cogema-PNC CEGB-Kepco	Dawn Lake	11 500	1.67	-	-
Cameco-Uranerz-Interur. Can.-Cogema Can.	McArthur River P2N	100 000	4-5	-	-
Cigar Lake Mining (Cameco-Cogema-Idemitsu-Corona Grande-Kepco)	Cigar Lake	148 000	7.84	-	-

Notes:
* Operator first
** 'Mineable' and 'Geological' are Cameco definitions. All figures in the table may not be exactly comparable.
*** 1992 production figures from Cameco annual report.
**** 1993 production estimated.
***** Rabbit Lake mill used ore from the Eagle 02 zone and the Collins B stockpile.

the positive results of old drill programs in areas close to the Dominique-Peter and Dominique-Janine mines.

Key Lake

Cameco, operator (66.7%); Uranerz Exploration and Mining Ltd. (33.33%)

Key Lake, where the Deilmann open pit is being mined, is the largest high grade uranium producing operation in the world. Key Lake produced 5452 t U in 1992, surpassing its 1991 record. Mining has been at an accelerated rate since 1991 so that the pit may be converted, assuming environmental approval, to a waste management facility in 1995. At the close of 1992 mineable reserves of 31 300 t U remained in the mine and stockpile. Deilmann will continue to supply feed to the mill until 1997, when ore from the McArthur River P2 North deposit, located some 70 km northeast, is scheduled to be transported to Key Lake for processing.

Cigar Lake

Cigar Lake Mining Corporation: Cameco (48.75%); Cogema Resources Inc. (36.375%); Idemitsu Uranium Exploration Canada (12.875%); and Korea Electric Power Corporation (2.0%)

The Cigar Lake Mining Corporation is developing the Cigar Lake deposit, with reserves estimated at 148 000 t U. Development consists of a shaft to 500 m and two levels: one at 420 m, above the orebody in the Athabasca Group sandstones, and the other at 480 m below the orebody in the Precambrian basement rocks. Test mining in frozen ground was carried out using two novel mining methods–jet boring and boxhole boring. Jet boring produced 113 t of ore grading 13.2 percent U, boxhole boring 53 t at 14.7 percent U. In jet boring, very high pressure water was used to cut out a cylinder-like cavity, the ore being moved to storage as a slurry. The boxhole method used a modified boring machine to cut a vertical entry, the ore then falls through a special chute into a shielded container. In both cases the excavation was backfilled with concrete. Following these successful test activities in 1990 to 1992, the site has been on a care and maintenance basis.

Work in 1993 includes preparation of a feasibility study. An Environmental Impact Study is scheduled for completion in the second quarter of 1994. Review by the Joint Federal-Provincial Panel on Uranium Mining Developments and license applications may take to the end of 1995 to complete. A further two years would be required for mine development and mill construction, if approvals are granted.

Midwest Property

Midwest Joint Venture: Minatco Ltd. (56%); Tenwest Uranium Ltd. (19.5%); Uranerz Exploration and Mining Ltd. (20%); and OURD (Canada) Co. Ltd. (4.5%)

After completing a deal in the first quarter of 1993 with Total Minatco Ltd., Denison Mines Ltd. retained a 19.5 percent interest in the Midwest uranium project through its subsidiary Tenwest Uranium Mines Ltd. and a 22.5 percent interest in the McClean Lake uranium project. Subsequently Total Minatco Ltd. agreed to sell all of its uranium interests, including those involving Denison Mines Ltd., to Cogema Resources Inc. These agreements allow for the development of the McClean Lake and Midwest properties by Cogema Resources Inc. in a complementary manner. The program proposed for the complementary operation is outlined below, together with the description of the McClean Lake property. Recent recommendations of the Joint Federal-Provincial Panel are for suspension of the Midwest project and a delay of at least five years for the McClean project, however, these have yet to be endorsed by the two levels of government.

McClean Lake Property

Cogema Resources Inc. (70%); Tenwest Uranium Ltd. (22.5%); and Ourd (Canada) Co. Ltd. (7.5%)

Under the proposed complementary operation of this property with the Midwest property, production was planned to begin mid-1995. Following a commissioning period, the mill would operate at 2300 t U/year until 2008. Mining of the JEB open pit, and construction of the mill and other facilities would start two years before the mill operations begin. When mining of the JEB site is complete, the pit would be prepared for tailings disposal prior to mill start up. Mining would continue with the SUE C open pit followed by the SUE A and B open pits and eventually the McClean Lake underground deposit. Development of the Midwest orebody was planned to begin in 1998 and ore from this mine custom milled beginning in 2000. A portion of the ore may be milled at the Rabbit Lake mill owned by Uranerz and Cameco. Published mineable reserves are 17 300 t U averaging 2.7 percent U on the McClean Lake property and 14 000 t U on the Midwest property. Combined reserves are in the order of 31 000 t U.

Exploration drilling has continued along the SUE trend with the objective of identifying additional high grade open pit reserves. According to company geologists the unconformity related SUE A, B, C, and CQ deposits are clustered on the western edge of the presumed Archean Collins Bay dome within a 2.9 km long northerly trending zone. The SUE A and B deposits are hosted by altered sandstones at and above the unconformity. The SUE C and CQ deposits occur in Wollaston Group basement rocks at depths of 8 m to 180 m below surface, which should allow open pit mining. The mineralization is located along a major faulted corridor, associated with extensive hydrothermal transformations overprinting older alteration events. In the SUE A and B deposits, uranium oxides and silicates are associated with Ni-Co arsenides and Fe-Ni-Co-Cu sulphides. The SUE C and CQ deposits consist mainly of uranium oxides. The SUE A and B deposits were discovered by drilling conductive zones delineated by ground VLF and HLEM (MaxMin) techniques. The SUE C and CQ deposits were identified by drilling DC resistivity and IP anomalies located 100 m away from the MaxMin conductor axis.

With this successful work, a new uranium 'SUE' type exploration methodology has been developed. It is applicable to areas where conductors have been drill tested on

widely spaced sections for single major uranium deposits like P2 North, Cigar Lake and Key Lake. Numerous sub-economic uranium drill intersections, especially in the southeast part of the Athabasca Basin, indicate that the 'SUE' type deposits, sometimes located 100 m off the EM conductor, could be found and exploited.

McArthur River

Cameco and its subsidiary Cameco Resources Ltd., operator (53.991%) (56.435%); Uranerz Exploration and Mining Ltd. (29.775%) (27.331%)*; Interuranium Canada Ltd. (9.063%); and Cogema Resources Inc. (7.171%)*
(*) These figures are ownership at production.

The McArthur River P2 North underground exploration project has proceeded with government approval. The major objective of the underground exploration is to properly define the orebody's limits, form, and reserves. Baseline environmental studies were complete in 1993. An EIS covering all aspects of mine design, and the effects of full scale production will be submitted at the end of the exploration phase, expected in the first quarter of 1995. Necessary materials were moved on site by winter road during the first quarter of 1993. The headframe was up by July and by late October the shaft had reached a depth of approximately 200 m. The site has a temporary camp, airstrip, offices, water treatment plant, and is connected to the Sask Power grid. The particularly favorable features of this deposit, based on surface exploration drill data are size, grade, and good silicified ground. Its location, only 70 km northeast of Key Lake, and ore composition, which is favorable to milling at the Key Lake mill, are other attractive parameters. Plans are to sink a shaft to the 630 m level and complete up to 25 000 m of infill, percussion, and diamond drilling on a selected part of the orebody. Possibly a second drift will be required on the 600 m level. The mine, costing in the order of $100 million, is planned to be in production by summer 1997, at up to 500 tpd, but will require governments' approval. To achieve production the all weather access road must be built in 1995 and mine development take place in 1996. Geological reserves are estimated to be approximately 100 000 t U grading 4 to 5 percent U. Anticipated mine life is approximately 20 years.

GOLD

Although grassroots exploration for gold declined this year, two underground test mines will be under development by year end. Only half a dozen gold exploration companies are active compared to over 60 in 1988, with interest focussed on the La Ronge and Glennie Lake domains. Claude Resources Inc., in spite of financial difficulties, operated the Seabee mine throughout 1993. Cameco, in joint venture with Uranerz, have begun phase one development of an underground test mine at the Contact Lake gold deposit on the Preview Lake property, and Waddy Lake Resources Ltd. will carry out an underground bulk sampling program on the Komis deposit. At present, the Contact Lake property offers the best chance of sustained gold production in northern Saskatchewan. The successful development of the Seabee, Contact Lake, and Komis properties will hopefully encourage gold exploration and help to reverse the decline in dollars available for grassroots gold exploration.

La Ronge Domain

Contact Lake

Cameco, operator (50%); Uranerz Exploration and Mining Ltd. (30%); and Westward Exploration Ltd.(20%)

The Cameco operated joint venture announced that they would proceed with the phase one development of an underground test mine at Contact Lake. Subsequently, Westward Explorations Ltd. elected to sell its share for approximately $4.6 million to the other members of the joint venture, who are obliged to pick up Westward's interest on a pro rata basis. Test mining will involve construction of a decline and mining of selected levels to verify ore grades indicated by drilling. Anticipated cost of the eight month test mine is approximately $4.5 million. Work began with the construction of a 5.5 km all weather access road. At the beginning of October, the road was completed and the decline collared and driven 100 m. As part of the development program, a 13 hole diamond drill program was carried out to intersect the orebody along the proposed test entry levels. Results from the first five holes confirm the exceptional widths and grades at these levels. If results from phase one are favorable, the joint venture partners will decide to move to phase two development and commercial production, including construction of a 750 tpd mill. This second phase would take about 12 months and cost an estimated $33 million. The joint venture's test mining decision is based on the results of a revised feasibility study and followed a mid-summer rise in the gold price. The feasibility study identified probable mineable reserves of 1 313 000 t averaging 8.01 g/t (0.23 oz/ton) Au. Based on these reserves the project is expected to produce 338,000 oz Au.

During the summer the joint venture carried out a ten hole, 5000 m, deep drilling program to a vertical depth of approximately 460 m below surface to test the down plunge extension of the main zone. The program showed the continuity of the gold mineralization and structure at depth, however in many of the holes, grades were below average and multiple intersections were common. The final, isolated hole of the program, which was drilled down plunge of the main zone, returned 9.23 g/t (0.269 oz/ton) Au across 3 m and a deeper intersection of 19.07 g/t (0.556 oz/ton) Au (uncut) across 2.5 m, approximately 366 m below surface. These intersections, which are similar to those in the main zone, could represent the top of a new zone at depth.

Byers Fault Area: Komis Deposit

Waddy Lake Resources Inc. (operator) 100%

Waddy lake Resources Inc. will be proceeding with its bulk sampling program on the Komis deposit. Cost will be in the order of $4 million. The program, which will start immediately with improved road access, is de-

signed to extract a 10 000 t bulk ore sample from the A and C zones accessed by a decline ramp. Cross cuts will be driven on the 400 m and 350 m levels to cut across all zones. Lateral drifts will also be driven on two levels in the A and C zones. Exploration raises between the levels will test the deposit's vertical continuity. The bulk sample will provide information regarding three dimensional grade continuity, underground mining and sampling methods, and potential for improved free gold recovery in the Jolu gravity circuit. Underground drilling will attempt to identify reserves along strike and down plunge of existing zones.

Mineable reserves at the Komis multi-zone deposit are 303 000 t grading 16.02 g/t (0.47 oz/ton) Au. This figure was calculated using the cross-sectional method, a cut-off grade of 5.15 g/t (0.15 oz/ton) Au, and 15 percent dilution. Waddy Lake Resources Inc. feels a full production decision can be made at the end of the program in four to six months, whereupon the decline would be extended to the 300 m level while mining the upper levels. A shrinkage mining method would produce 363 tpd at a cost of close to $100/t. Under these circumstances, the mine would be in full production by the third quarter of 1994 at an annual rate of 50,000 oz Au.

The Komis bulk sample will be hauled approximately 75 km south to the Jolu mill for processing and testing. The Komis is the first of eight properties all in the development stage through closely spaced drilling, to be tested underground. The other seven deposits are Tower East, Golden Heart, Weedy B zone, Niko, Corner Lake, EP, and Twin. Table 3 lists published reserves for these deposits. The company's long term plan is to move the Jolu mill to the Komis site, when the Weedy B and Golden Heart deposits are developed.

Other La Ronge Domain Prospects

Uranerz continued their grassroots exploration program without reporting significant new finds. Alligator Resources Ltd., a Saskatoon based prospecting syndicate, sluiced and sampled the "Broken Hammer Vein" again on CBS 6120, northeast of Waddy Lake. Kristo Gold Inc. reported in a letter to shareholders that the Anglo-Rouyn mine pilot plant operation in the fall of 1992 was a success in spite of problems with high magnetite concentrations. The plant was designed to test the feasibility of reclaiming gold, silver, and copper from the mine tailings. No firm plans to move to a commercial operation have been announced. Following a successful bulk test on a representative 0.45 t sample, Durama Enterprises Ltd. plan to mine and mill on site from 2000 t to 3000 t from the first 10 m of the Pap Southwest gold zones. This operation will require government approval. Prospecting in the immediate area of an unexplained gold biogeochemical anomaly located by Dr. C. Dunn at Upises Lake, Highrock Contracting Ltd. and Ted Kennedy and Associates Ltd. found *in situ* gold mineralization. Values of up to 154 g/t (4.5 oz/ton) Au and 205.8 g/t (6 oz/ton) Au have come from a silicified, east-northeast-trending shear in granodiorite that parallels the Contact Lake structure approximately 1 km to the south.

Exploration activity in the La Ronge Domain is disappointing considering the number of finds produced by the flow through share exploration boom experienced in the late 1980s. The potential for new gold discoveries in the area is not exhausted nor have existing prospects yet been fully explored at depth.

Glennie Lake Domain

Seabee

Claude Resources Inc. (100%)

The Seabee mine has done well in 1992, recovering 58,664 troy oz Au from 167 515 t of ore with an average mill feed grade of 11.57 g/t (0.34 oz/ton) Au. Milling rate was 458 tpd. Development at zone 5 began in July 1992, with this zone providing 20 000 t of ore and zone 2 providing 148 000 t in 1992.

During the first 10 months of 1993, a total of 143 823 t grading 11.12 g/t (0.32 oz/ton) Au has been treated and 48,478 oz Au recovered. Ore broken during 1992 totalled 168 000 t at 10.3 g/t (0.3 oz/ton) Au and, in the first ten months of 1993, 162 000 t at 10.1 g/t (0.3 oz/ton) Au (grade estimation is based on a 50 g/t (1.46 oz/ton) Au cut). Mine development at zone 2 has advanced to the 365 m level and at zone 5 to the 85 m level. Ore reserves have improved during the past year, standing at 225 000 t at 11.1 g/t (0.32 oz/ton) Au at the end of September 1993, sufficient for 15 months operation.

Claude Resources Inc. was successful in reaching a settlement with its creditors in the fall of 1993, and is cautiously optimistic that additional reserves will be discovered as underground development proceeds and as exploration on and off the property at Santoy Lake continues. Continued mining at Seabee should help to revive exploration for gold in Glennie Lake Domain which was very quiet this year. New showings found in this domain during the period 1985-1991 clearly indicate a potential for new discoveries.

Other Glennie Lake Domain Prospects

West Coast Ventures, a company affiliated with D. Hoffman, has optioned the Prongua-Larivière prospect owned by W. Fisher and previously drill tested by Placer Dome Inc.

BASE METALS

Although base metal expenditures in 1993 will be similar to those for 1992, the area of work moved from the sub-Phanerozoic southwest and east of Flin Flon onto the Precambrian Shield. Noranda Exploration Co. Ltd. has an interesting new venture in the Wollaston Domain designed to find stratiform base metal deposits. Of the sub-Phanerozoic programs designed to find volcanogenic massive sulphide deposits, only the Granges Inc. operated joint venture at Bigstone Lake remained active.

The Hudson Bay Mining and Smelting Co. Ltd.'s new zinc plant at Flin Flon is complete and operating despite cost overruns, which increased the total cost from $120

million to $171 million. The new plant, based entirely on pressure leaching, eliminates roasters and reduces associated sulphur dioxide emissions by about 25 percent and airborne particulates by about 50 percent. Plans for the copper smelter upgrading have been indefinitely postponed.

Callinan Deposit

Hudson Bay Mining and Smelting (100% subject to 6.67% NPI with Consolidated Callinan Flin Flon Mines Ltd.)

Mining of the Callinan copper-zinc deposit continued in 1992-93 with production from the Callinan South, East, and the lower portions of the Callinan North zones, all located in Manitoba. The bulk of production was derived from the Callinan South zone, although the East zone is providing an increasing proportion of current output. From April 1990 to July 31, 1993 the mine produced 1 310 000 t grading 1.42 percent Cu, 3.89 percent Zn, 2.02 g/t (0.059 oz/ton) Au, and 23.67 g/t (0.69 oz/ton) Ag. As of January 1, 1993, measured mineable reserves (<30 m drill spacing) were 1 960 000 t grading 1.6 percent Cu, 3.68 percent Zn, 2.23 g/t (0.065 oz/ton) Au, and 24.7 g/t (0.72 oz/ton) Ag and indicated mine-

Table 3 - Published reserves from selected Saskatchewan gold properties.

Owner(s)*	Property	Reserves (t) or Production (t)	Grade g/t	Grade oz/ton
	MINED			
Cameco-Starrex-Uranerz	Star Lake Mine	76,750 ozs		
	21+Rush zones**	182 541	14.4	0.42**
Cameco-Shore Gold	Jasper Mine	82,697 ozs		
		140 127	18.8	0.55*
Corona Corp. Int. Mahogany Corp.	Jolu Mine	203,301 ozs		
	Rod+Mallard**	472 200	13.8	0.40**
	MINEABLE			
Cameco-Uranerz-Westward	Contact Lake Mine Bakos zone	1 313 000	8.01	0.23
Waddy Lake Res.	Komis	303 000	16.1	0.47
Claude Resources Inc.	Seabee	225 000	11.1	0.32
	GEOLOGICAL			
Cameco-Golden Rule Res.-Int. Mahogany Corp.	Corner Lake	181 000	13.0	0.38
Cameco-Uranerz-Westward	Pap SW	365 000	12.1	0.35
Golden Rule Res.	Niko	85 700	6.2	0.18
Golden Rule Res.-Int. Mahogany Corp.-Comaplex Res.	Tower East	922 000	6.9	0.2
Radcliffe Res. Inc.	"North" Lake	2 360 000	2.4	0.07
RJK Mineral Corporation	Athona	4 500 000	1.9	0.05
	Box Mine	22 675 000	1.85	0.05
Royal Oak-Golden Rule Res.-Cameco	Twin	351 100	6.2	0.18
Tyler Res.-Golden Rule Res.-Cameco	Weedy B	314 000	4.8	0.14
	Golden Heart	687 000	10.3	0.3
Waddy Lake Res.	EP	227 000	5.8	0.17

Notes:
* Operator first
** Mined out

able reserves (30 to 60 m drill spacings) were 1 615 000 t grading 1.61 percent Cu, 3.4 percent Zn, 2.74 g/t (0.08 oz/ton) Au, and 24.61 g/t (0.77 oz/ton) Ag. Geological reserves in the Upper Callinan North zone, which lie predominantly within Saskatchewan and have not been mined, are 562 200 t grading 1.71 percent Cu, 4.1 percent Zn, 2.0 g/t (0.057 oz/ton) Au, and 22.64 g/t (0.66 oz/ton) Ag.

Sub-Phanerozoic Area

The Cameco (operator)/Billiton Metals Canada Inc. joint venture on the McIlvenna Bay volcanogenic massive sulphide deposit at Hanson Lake was inactive again this year. A revaluation of drill results produced revised geological reserves of 13 100 000 t of 1.26 percent Cu, 4.95 percent Zn, 0.52 g/t (0.015 oz/ton) Au, and 24.3 g/t (0.71 oz/ton) Ag. Although the sulphide lenses are narrow, they remain open to depth. The Granges Inc. (operator)/Cameco Corp. joint venture was active on the Bigstone Lake property with a program including detailed compilation of previous work and drill investigation of a dozen shallow targets identified by geology, and airborne, and ground geophysics. The Namew Lake deposit in Manitoba is scheduled to shut down in the last quarter of 1993. Uneconomic mineralization, at current nickel prices, remains at depth. The deposit was found in 1984 and production began in the fall of 1988. By September 30, 1993, 2 330 000 t grading 1.79 percent Ni and 0.63 percent Cu had been mined down to the 360 m level. The Namew Lake mine has led to a number of exploration drill programs for similar ultramafic-hosted nickel deposits in the Hagan-Saskoba lakes area. Last winter Hudson Bay Exploration and Development Ltd. drilled geophysical targets based on this model.

Kisseynew Domain

Exploration for massive sulphides continued in 1993 at a low level. Sarabat Gold Corp. completed a small drill program on the Schotts Lake prospect which the company optioned from O.M.T. Oil Ltd. Reported geological reserves at Schotts Lake are 2 000 000 t averaging 0.61 percent Cu and 1.35 percent Zn. The predominantly zinc-rich deposit is hosted in complexly folded amphibolite facies volcanic rocks. BHP Utah Mines Ltd. and Cominco Ltd. worked in the Wildnest-Attiti lakes area, however their programs did not include drilling.

Wollaston Domain

Noranda Exploration Co. Ltd., using known base metal showings and several stratiform, sediment hosted deposit models, acquired a total of nearly sixty claims over Wollaston Domain metasediments. The claims encompass the Duddridge, Sito, Fable, Johnson (N), Janice, and Rafuse Lake copper and zinc-lead showings. The company's summer 1992 program was followed by a 3700 m winter drill program in the first quarter of 1993. Three separate areas returned encouraging results from shallow drill holes. Base metal mineralization was discovered by testing geophysical anomalies up ice from high grade, up to 10 percent Zn and 3.9 percent Cu, boulder trains. At Hewetson Lake, about 125 km north of La Ronge, one hole cut 40 m grading 2.5 percent Zn in a shale-sandstone sequence. About 15 km further northwest, at Sito Lake, a similar host rock yielded 40 m grading 1.9 percent Zn. A hole on a third target in the Janice lake area intersected 33 m of

Table 4 - Published reserves from Saskatchewan base metal properties.

Owner(s)* Venture Operator	Property	Reserves (t) or Production (t) (t X 10^3)	Grade Cu %	Zn %	Pb %	Au g/t	Ag g/t
	MINEABLE						
Cameco-Billiton	McIlvenna Bay	13 100	1.26	4.95	-	0.5	24.3
HBM+S	Callinan East, South Lower North						
	Measured**	1 960	1.6	3.7	-	2.2	24.7
	Indicated***	1 615	1.6	3.4	-	2.7	26.4
	Production	1 310	1.4	3.9		2.0	23.9
	GEOLOGICAL						
Granges-Cameco	Bigstone Lake	1 451	2.9	-	-	-	-
		308	-	11.2	-	-	-
HBM+S	Callinan North**** (Sask)	562	1.7	4.1	-	2.0	22.6
Longyear option to Phelps Dodge	Brabant	3 500	0.54	4.5	0.24	0.2	17.2

Notes:
* Operator first
** <30 m drill spacing
*** 30 to 60 m drill spacing
**** Geological resources

native copper and chalcocite bearing conglomerate grading 0.77 percent Cu from 49 m to 82 m down the hole. John Harvey, president of Noranda Exploration Co. Ltd., was reported to compare the native copper and chalcocite mineralization to that of the Upper Peninsula of northern Michigan and the sphalerite mineralization to the lead-zinc deposits of the western United States. Harvey summarized the results by saying that the mineralized holes had the required width, but not the grade. The exploration objective is to find the source of the high grade boulders or a higher grade zone. The company plans to spend $2 million this year on prospecting and geophysical surveys. A 1994 winter drill program is expected. Apart from Cominco Ltd. who have staked ground in the Campbell River belt, no other companies are involved in this play.

Other Base Metal Projects

Hudson Bay Exploration and Development Ltd. continued to explore along past and present producing horizons including Birch Lake, Callinan North, and Flin Flon Main. Phelps Dodge Corporation of Canada Ltd. drilled targets on the 'McKenzie orebody' or Peg property, now ML 5054, which had lain dormant until Gamsan Resources Ltd. drilled 18 new NQ holes in 1988-89. Noranda Exploration Co. Ltd. drilled on the Reindeer River and Stackhouse Bay, Reindeer Lake options from Consolidated Pine Channel Gold Corp., but decided not to proceed with these projects.

DIAMONDS

Recent discoveries in the Slave Province in the Northwest Territories have resulted in a diamond exploration boom. These exciting finds have also served to revitalize and expand Saskatchewan's diamond play centered on the Fort à la Corne kimberlite field. As of October 14th, 1993, 2 311 073 ha, or four times the November 12th, 1992 figure, were under disposition predominantly in an area running across the province between latitudes 53° and 56°. Most of the properties lie in the Fort à la Corne, Pasquia Hills, Molanosa Arch, and Sturgeon, Smoothstone, and Wapawekka lakes areas. The play does extend northwest out of this area to La Loche. Work in this expanded Fort à La Corne area consists mainly of ground detailing government or industry aeromagnetic anomalies and drilling. Simply put, the play is to test 'bullseye' magnetic anomalies, which are magnetic highs in this area–at Lac de Gras the 'bullseyes' are magnetic lows.

By the end of 1994, Monopros Ltd. will have earned a one third interest in the Uranerz/Cameco Fort à la Corne joint venture by contributing funds. Uranerz's interpretation of Geological Survey of Canada aeromagnetic maps in 1988, first indicated that kimberlitic intrusions might exist in the area. Because overburden thickness is >100 m, magnetometer surveys continue to be the main exploration tool in defining pipe locations and sizes. The Uranerz operated joint venture has outlined one main kimberlitic cluster, some 10 km by 50 km in size, and two subclusters in this way. Over 70 individual targets are interpreted as probably representing kimberlites ranging in size from 1 ha to 74 ha. To the end of 1991 the joint venture's exploration program had recovered 160 macrodiamonds (>0.5 mm), many of gem quality, from a total kimberlite sample of 186 t taken from 15 pipes. The 1992 large diameter (25 cm) drill program's objective was to recover diamonds with a minimum size of 1 mm. The samples were screened through a mesh of 0.85 mm, eliminating any recovery of microdiamonds. Drilling on 3 kimberlite bodies yielded 138 macro-diamonds with a total weight of 7.610 carats from samples having a total weight of 131.7 t. The largest stone, 0.985 carats, was part of a 28 macrodiamond parcel (2.72 carats total weight) from an 11.592 t sample taken from a large diameter hole in one of the kimberlite bodies. A second drill hole from this body returned 7 macrodiamonds (0.28 carats total weight) from a 18.086 t sample. The other two kimberlite bodies tested had macrodiamond recoveries of a similar order of magnitude. The sizes of the bulk samples recovered were too small to permit valid grade estimates to be calculated. To the end of the 1992 program, 25 kimberlites had been identified by drilling since the exploration program began in 1988. The 1993 exploration drill program includes drill sampling for improved recovery tests. Uranerz thinks that significantly improved results are required before the corporation upgrades its assessment from uneconomic. Nevertheless, Uranerz does think the results are promising and that the project is worthy of further work.

Rhonda Mining Corp., and some fourteen partners, form the biggest group of landholders in the play. In March 1993, the total area in which Rhonda Mining Corp. had an interest, was over 1 214 100 ha. The corporation operated six joint ventures at the end of 1992. The Rhonda Mining Corp. (50%) and Aaron Oil Corp. (50%) joint venture ran two diamond drill programs using small diameter core in the Fort à la Corne area. Of nine holes completed, six cut kimberlites. The Aaron Oil Corp. 1992 annual report illustrates the uneroded kimberlite crater model for the Fort à la Corne area. The model implies a significant uneroded, horizontal component and thereby considerable tonnage potential. At least some of the diamondiferous kimberlite systems reported by the Uranerz/Cameco/Monopros joint venture extend onto the surrounding ground held by the Rhonda Mining Corp./Aaron Oil Corp. joint venture. The kimberlite found in the first Rhonda Mining Corp. operated drill program forms a widespread blanket preserved beneath gravels, sands, and a thin veneer of mid-Cretaceous mudstone. The structures are volcanic craters with breccia features surrounded by an outwardly thinning apron of layered kimberlite volcanics and sediments. The sequence is characterized by the usual indicator minerals especially pyrope garnet, chrome diopside, spinel, ilmenite, and perovskite. Pyrope garnets form 40 percent of all garnets and approximately 10 percent of these are G10 garnets. Cores from these units have been found to contain up to six percent magnetite and one percent ilmenite/perovskite. Six microdiamonds have been recovered from these horizons to date; processing continues. The small diameter of the initial exploration drill cores, designed for interpretative results, does not allow the estimation of diamond grades. In 1993 Rhonda Mining Corp. completed one low level, high resolution, airborne

magnetic survey with ground geophysical follow up. New plans include a second airborne magnetic survey at Carrot River where helium gas occurrences are interpreted to suggest the presence of mantle derived rocks (kimberlites). Continuing with small diameter cores, the current drill program aims at evaluating discrete airborne anomalies, and determining the geographic extent of the aprons and enriched zones within the widespread kimberlite bodies.

The company recently reported (November 15, 1993) recovery of 20 natural diamonds including coloured diamonds from three cores drilled in volcanic kimberlite in February and March 1993, in the Snowdon area. One of the diamonds was a yellow macrodiamond fragment, the others were microdiamonds of both white and yellow colour. Two yellow microdiamonds are also reported from September 1993 drilling of a kimberlite 'cone/crater' in the Foxford area.

Consolidated Pine Channel Gold Corp. and four other companies ran a series of well funded joint ventures principally in the general area of the Molanosa Arch. The exploration effort is based on work by Malcolm Gent reported in Saskatchewan Energy and Mines Open File Report 92-2. Gent interpreted elliptical 'bullseye' aeromagnetic anomalies as possible kimberlite intrusions and wrote that kimberlite emplacement is commonly associated with anticlinal features such as the Molanosa Arch. At first, staking was based on the Geological Survey of Canada's 1 inch to 1 mile aeromagnetic maps. Later, additional anomalies were staked on the basis of a 26 000 line kilometer, low level aeromagnetic survey. Prioritized anomalies were detailed with ground magnetic surveys in both cases. A first phase drill program was designed to complete 12 000 m of drilling. On July 23rd, over $5 million was reported committed to these ventures by Consolidated Pine Channel Gold Corp. and its various partners. A similar venture is also active in the Tobin Lake area northeast of Fort à la Corne, where the company recently reported intersecting altered pyroclastic kimberlitic material with purple pyrope garnets at Tobin Lake. Other companies with substantial exploration programs are: Falcon Ventures International Corp., Formation Capital Corp., Kensington Resources, Morgain Minerals Inc., Orcana Resources Ltd., War Eagle Mining Co. Ltd., and Great Western Gold Corp.

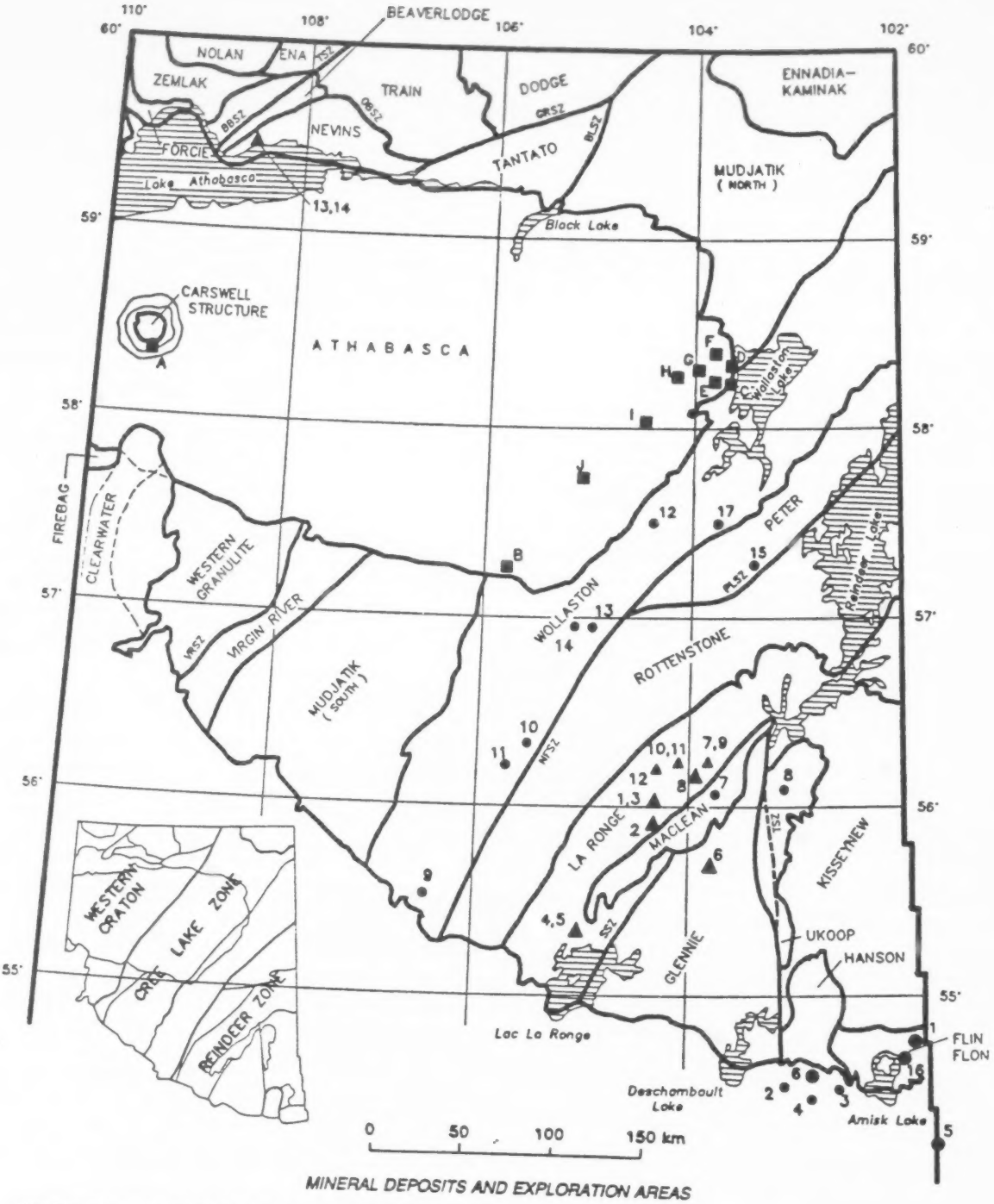
Another diamond play is developing in south-central to southwestern Saskatchewan. Exploration here, unlike that carried out in much of the Fort à la Corne area, is at a preliminary, grass roots stage, and is based on the occurrence of widespread kimberlitic indicator mineral anomalies. Tracing of indicator minerals can be employed effectively as glacial overburden thickness is very limited. Aeromagnetic surveys with detailed ground follow up are also being used in conjunction with indicator mineral sampling to prioritize drill targets. Drilling is anticipated in the near future.

The consortium of Diamond Field Resources Ltd., Super Twins Resources Ltd. and Lumina Investment Corp. are actively working on the 'Willow Project' in southwest Saskatchewan. Better Resources Ltd. is also conducting a substantial exploration program in this area. Numerous other mineral dispositions in the southern part of the province are also believed to be staked for diamond exploration.

The 1993 diamond exploration play in Saskatchewan will certainly result in more exploration work than was done on land staked after the original Sturgeon Lake kimberlite find in 1988 and may identify new kimberlites with sufficient grades to support a diamond producer. Hopefully diamond exploration is here to stay.

Acknowledgments

Personnel in Cameco Corporation, Cigar Lake Mining Corporation, Claude Resources Inc., Cogema Resources Inc., Consolidated Pine Channel Gold Corporation, Golden Rule Resources Ltd., Hudson Bay Mining and Smelting Ltd., Minatco Ltd., Noranda Exploration Co. Ltd., Uranerz Exploration and Mining Ltd., and others assisted the authors in the preparation of this report.



MINERAL DEPOSITS AND EXPLORATION AREAS

Uranium (squares): (A) Cluff Lake, (B) Key Lake, (C) Rabbit Lake, (D) Collins Bay–Eagle Point, (E) McClean Lake, Sue Trend, (F) Jeb, (G) Dawn Lake, (H) Midwest, (I) Cigar Lake, and (J) P2 North.

Gold (triangles): (1) Jolu Mine, (2) Jasper Mine, (3) Star Lake Mine, (4) Contact Lake Deposit, Bakos zone, (5) Pap SW, (6) Seabee Mine, (7) Weedy B–Golden Heart, (8) Komis, (9) Twin, (10) Comer, (11) Tower East, (12) Niko, (13) Box Mine, and (14) Athona Mine.

***Base Metals** (circles): (1) Flin Flon and Callinan mines, (2) Bigstone Lake, (3) McDermott Lake, (4) Miskat Lake, (5) Namew Lake Mine, (6) McIlvenna Bay, (7) McKenzie, (8) Linda, (9) Duddridge, (10) Sito East, (11) Fable, (12) Johnson-Marina, (13) Juno, (14) Kaz, (15) Campbell River, (16) Birch Lake, and (17) George Lake.*